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iPads versus laptops: The effects of mobile device interfaces on students' attitudes towards technology and learning

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IPADS VERSUS LAPTOPS: THE EFFECTS OF MOBILE DEVICE INTERFACES ON STUDENTS' ATTITUDES TOWARDS TECHNOLOGY AND LEARNING

An Abstract of a Thesis

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Instructional Technology

Evans Lugalia Mudanya

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ABSTRACT

Although iPad and laptop interfaces look similar, users interact with them in significantly different ways. The differences in these interfaces may lead to attitudinal differences towards technology and learning. In an attitudinal survey taken by 39 UNI Malcolm Price Laboratory School (MPLS) students, possible attitudinal differences of students based upon the two interfaces were investigated. This preliminary ex-post facto study investigated whether there is any relationship between the type of mobile devices used in a ninth grade English class and the students' attitudes towards technology and learning. The study also explored if a relationship between attitudes toward technology and learning existed based upon whether or not the students used mobile devices in class. The study found a statistically significant difference in attitude towards learning between ninth grade mobile device users and eighth grade students who did not have mobile devices. There was neither a statistically significant difference in attitude towards learning nor technology in regard to ninth grade students who used different types of mobile devices (iPads and laptops). As pertains to eighth grade students who did not use mobile devices and ninth grade students who used mobile devices, the study found there was no statistically significant difference in attitude towards technology. Nevertheless, there were a few survey items that showed statistically significant differences in attitude towards technology and learning among the groups. The researcher recommends a repeat of this study with a larger sample size as shown by the effect sizes. This is likely to show statically significant differences among the groups.

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This Study by: Evans Lugalia Mudanya

Entitled: IPADS VERSUS LAPTOPS: THE EFFECTS OF MOBILE DEVICE INTERFACES ON STUDENTS' ATTITUDES TOWARDS TECHNOLOGY AND LEARNING

has been approved as meeting the thesis requirement for the

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10/29/12 — Date — Dr. Leigh Zeitz, Chair, Thesis Committee

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Oct 29. 2012 — Date — Dr. Ping Gao, Thesis Committee Member

11/27/12 — Date — Dr. Michael J. Licari, Dean, Graduate College

DEDICATION

This thesis is dedicated to my parents who are departed and who taught me the benefits and opportunities of a good education and supported me throughout my life. I also dedicate this thesis to my Brother Cyrus Havi Mudanya for believing in me and for the words of hope and encouragement especially when I arrived here in the US to begin this adventurous educational journey.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Computers are not a recent educational innovation. If you live in 21st century America, one might easily forget that less than 20 years ago personal computers were bulky, slow, unattractive and expensive. The few classroom networks that existed were hard-wired slow, and software was mostly text-based though very expensive.

For close to 35 years, enormous interest has grown around the United States leading to continuous investment in one-to-one computer programs designed to provide each student with a computer to support academic learning (Rockman, Chessler, & Walker, 1998). In the very early days the program was solely based on desktops, only few people knew about laptops.

The one-to-one computer access movement began in the 1980s with the Apple Classrooms of Tomorrow (ACOT) project. ACOT was the first large-scale initiative providing one-to-one access to students and teachers. The laptops had not been invented at this time period therefore there was no use of mobile devices. The schools were given enough desktop computers (Apple IIgs) for each student to use at school, at the same time students were given an Apple IIgs for their homes. By implementing ACOT project classrooms for digital teaching and learning, the project sought, to not only examine, but also to promote a changing educational context (Dwyer, Ringstaff, & Sandholtz, 1990). Studies have shown that student, teacher, and parent perceptions supported the concept that access to computers facilitated more engagement in reading and writing, doing more

homework and doing more school-related research which reflects on students' attitudes (Shrout, 2004).

The laptop has been around for close to 25 years. Enormous interest has grown around the nation leading to continuous investment in one-to-one mobile device (laptops) programs designed to provide each student with a laptop computer 24 hours a day, seven days a week to support academic learning (Rockman et al., 1998). The first time mobile devices in one-to-one programs started in the US was in the mid-1990s. The most widespread one-to-one laptop program at that time was The Microsoft's Anytime, Anywhere Learning program. The way the program was set up was that schools and districts implement programs with guidelines that students lease or buy laptops they and their teachers were to use in their school **(**Penuel, 2006).

According to the 2006 eSchool News report, it was forecasted that by 2007 about 25% of school districts in the United States would implement some form of a one-to-one (one mobile computer per child) computing initiative in their districts. One-to-one initiative existed in a wide variety of settings in Georgia, Florida, Kansas, Louisiana, Maine, Massachusetts, Michigan, Missouri, New Hampshire, Pennsylvania, and South Dakota by this time (Holcomb, 2010). Currently, one-to-one program initiatives exist in a variety of forms and extents in all states in the nation. Since 2006, the growth of one-to-one programs in schools has been steady.

Mobile computers were initially introduced into schools to expand the available learning opportunities and student capacities. An important aspect of the one-to-one learning experience is how the iPad and laptop interfaces might affect students' attitudes

towards technology and learning. Not to mention, students' positive attitude of mobile computing devices towards technology or learning might translate to high students' achievement as well. More specifically, it may be possible for the types of mobile computer interfaces to affect students' attitudes differently. As explained by Davis, Bagozzi and Wardshaw (1989), the Technology Acceptance Model (TAM) is a theory crafted to model how users come to accept and use technology. This model is used to define attitude as it is used in this study. TAM is modeled after another theory TRA: The Theory of Reasoned Action (Glatz, Rimer, & Viswanath, 2008) replacing most of TAM'S attitude measures with the two technology acceptance measures— *ease of use*, and *usefulness* (Glatz, Rimer, & Viswanath, 2008). Davis et al., (1989) defined perceived usefulness (PU) as the degree to which a person believes that using a particular system would enhance his or her job performance. On the other hand, Davis et al., (1989) defines perceived ease-of-use (PEOU) as the degree to which a person believes that using a particular system would be free from effort (Davis et al., 1989).

There is a perceivable difference between the laptop and iPad interfaces. The laptop provides a physical keyboard used for interacting with information seen on the screen. When using the laptop, data is typed into the computer using the keyboard and the cursor is controlled using a mouse pad or arrow keys. On the contrary, the iPad provides a more direct user interface interaction with the user. The whole user interface is screen-based. Data is entered using a screen-generated keyboard and the cursor is controlled directly by touching the screen. Due to the differences, this preliminary study examined

whether students' continual use of one user interface over the other might affect a student's attitude towards technology or learning in general.

This study compared the attitudes of ninth grade students in two English classes using a survey. One class was comprised of students who used personal iPads in their ninth grade courses and the other class included laptop-using students during the same year. The researcher also wanted to study if there was any difference in attitudes between computer-using and non-computer-using students. Since all of the ninth grade students at MPLS had their own mobile computers, the same attitude survey was given to an English class of eighth grade students who did not have computers.

The research questions this study investigated were:

1. Are there significant differences in attitudes towards learning between ninth grade students who use personal iPads and those who use personal laptops?
2. Are there significant differences in attitudes towards technology between ninth grade students who use personal iPads and those who use personal laptops?
3. Are there significant differences in attitudes towards learning between ninth grade student who use portable computing devices daily and eighth grade students who do not?
4. Are there significant differences in attitudes towards technology between ninth grade student who use portable computing devices daily and eighth grade students who do not?

Through a survey, this study measured learners' attitudes towards technology and learning. It investigated the differences in attitudes between students who used iPads and

those who used Macintosh Laptops for one year at UNI Malcom Price Laboratory School (MPLS).

Statement of the Problem

iPad and laptop Macintosh computers are similar in their functions but different in how a learner interfaces with them. There has been little research on the effects of these user interface differences on students using these devices. It is possible that success or frustration in using these different interfaces can cause differences in students' attitudes towards technology and learning. Although exploratory, this study acted as a significant beginning of investigations into the effects of differing interfaces.

Purpose of the Study

The purpose of this study was to identify whether there was any relationship between the type of mobile computer used in a ninth grade English class and the students' attitudes towards technology and learning. Furthermore, the study explored the existence of a relationship between attitudes toward technology and learning based upon whether or not the students used mobile devices in class.

Significance of the Study

Few studies have been done on the effects of keyboard versus touch screen interfaces on student learning. Previous studies examined achievement in relation with technology. This study investigated attitudes towards technology and learning. Specifically, this study examines iPads against laptops in regard to their interface technology. This study is particularly important in that it may assist education administration in determining which computing devices to select for their students based

upon how a specific interface can affect one's attitude towards technology or learning. It is important to investigate attitude because it precedes achievement. The way learners feel, think and manipulate their mobile devices may shape their attitudes which in turn might affect their achievement.

Since MPLS had just begun a 1-to-1 program for ninth– 12th grade students, it could be useful to evaluate how the various types of interfaces might affect students' attitudes towards technology and learning. The results of such a study could guide decisions about expanding their program. This kind of study has not been done before at MPLS.

Hypotheses

This study investigated the following four hypotheses:

Hypothesis 1: There is a statistically-significant difference in attitudes towards learning between ninth grade students who use personal iPads and those who use personal laptops.

Null Hypothesis 1: There is no statistically-significant difference in attitudes towards learning between ninth grade students who use personal iPads and those who use personal laptops.

Hypothesis 2: There is a statistically-significant difference in attitudes towards technology between ninth grade students who use personal iPads and those who use personal laptops.

Null Hypothesis 2: There is no statistically-significant difference in attitudes towards technology between ninth grade students who use personal iPads and those who use personal laptops.

Hypothesis 3: There is a statistically-significant difference in attitudes towards learning between ninth grade student who use portable computing devices daily and eighth grade students who do not use mobile devices.

Null Hypothesis 3: There is no statistically significant difference in attitudes towards learning between ninth grade student who use mobile computing devices daily and eighth grade students who do not use mobile devices.

Hypothesis 4: There is a statistically-significant difference in attitudes towards technology between ninth grade student who use mobile computing devices daily and eighth grade students who do not use mobile devices.

Null Hypothesis 4: There is no statistically-significant difference in attitudes towards technology between ninth grade student who use mobile computing devices daily and eighth grade students who do not use mobile devices.

CHAPTER 2

LITERATURE REVIEW

Many educators and other stakeholders believe that mobile technologies are leading to fundamental changes in teaching and learning (Gawelek, Spataro, & Komarny, 2011) to the extent that big companies are investing heavily into ubiquitous technologies: technologies that exist everywhere at the same time like wireless, mobile networked computers. For example Massachusets Institute of Technology (MIT) in 2005, suggested that the state buy each student in the state a $100 laptop, a bold move to the significance of ubiquitous learning (Fratt, 2005).

Over 60 million iPads have been sold since April, 2010 (Statista Corporation, 2010). In the first 45 days after the iPad's release, over 47,000 were sold to educational institutions (Statista Corporation, 2010). The iPad has unquestionably had a significant impact in the academic world. On the other hand, Macintosh laptops have been around for about 21 years since the introduction of the PowerBook 100 in 1991 (Wikimedia Foundation, Inc., 2012) and are permanent fixtures in many schools. Questions have been raised, however, about the educational value of a learning strategy so heavily dependent on the use of iPads and laptops to experiment on new pieces of mobile technology—a few doubting educationists have called the mobile devices a gimmick, a marketing tool, a toy, or a passing technology whim (Statista Corporation, 2010).

Mobile Device Interfaces

The laptop provides a notebook design where one has to open it up to use it. After opening, it displays an interface with a physical keyboard and a screen. The keyboard and

mouse or touch pad are used for interacting with information seen on the screen. When using the laptop, data is typed into the computer using the keyboard and the cursor is controlled using a computer mouse, touch pad or arrow keys on the keyboard. Conversely, the iPad provides a much more direct interface interaction with the user.

The iPad has not been in the educational arena as long as the laptop. However, it is picking up popularity in many schools around the nation alarmingly fast due to its slick appearance, small size, light weight, crystal clear images, and appeal for how items populate and display on the screen. The whole iPad interface is screen-based. It is aesthetically slim and ultra-light weight tablet. It doesn't come with a separate keyboard or mouse though it is possible to connect either device to it.

The iPad's interface is highly interactive and displays high-definition images. It provides a touch screen technology where users can use their fingers to swipe, scroll or pinch things to smaller sizes on the screen. When using an iPad, entry of data is done using a screen-based keyboard and the cursor is controlled directly by touching the screen. It also comes with speech recognition software as another option for data entry.

Attitudes Towards Technology

There have been few studies about students' attitudes towards technology. (Holcomb, 2010; Dickens & Churches, 2011; Ozturk, 2011; Kahveci, 2010) The studies have discovered that students enjoy working together more, complete tasks within a stated time, and find work easy to do using mobile computers. Some studies have found that integrating technology into the curriculum has improved students' attitudes towards learning.

The one-to-one computer access movement began in the 1980s with the Apple Classrooms of Tomorrow (ACOT) project. ACOT was the first large-scale initiative providing one-to-one access to students and teachers. There was no use of mobile devices at this time period. The schools were given enough desktop computers (Apple IIgs) for each student to use at school at the same time students were given an Apple IIgs for their homes. By implementing ACOT project classrooms for digital teaching and learning, the project sought, to not only examine, but also to promote a changing educational context (Sandholtz et al., 1997). Studies have shown that student, teacher, and parent perceptions supported the concept that access to computers facilitated more engagement in reading and writing, doing more homework, and doing more school-related research which reflect on students' attitudes (Shrout, 2004).

Attitude is a key variable that affects using technology in schools. Mouza (2006) researched the impact of one-to-one computing on third and fourth grade students' attitudes. The research was based on a collection of both quantitative and qualitative data. Although some evidence indicated that fourth grade laptop students had more positive attitudes toward school than fourth grade non-laptop students, quantitative data did not reveal significant differences among laptop-using and control students. Qualitative data, however, painted a positive picture of experiences in laptop classrooms (Mouza, 2006).

Technology has changed the thinking process of students. Instead of students asking for notebooks, they are asking for Google Docs, instead of asking for atlases, they are asking for Google Maps or MapQuest, and instead of asking for erasers and pens, they are asking for microsoft office, the internet and netbook computers. It will be useful

to discover how students' attitudes towards technology and learning might be affected by interacting with these technologies.

Attitudes Towards Learning

Learning has been and is being transformed everyday with technology. Although it is difficult to measure how much technology contributes to good grades, it is easy to see how the process of learning is changing for the better due to the advent of technology in schools. The teacher is no longer the sage on the stage, but definitely the guide on the side with the use of mobile devices, which provide endless opportunities to use of different technologies in classrooms. Technology has enabled cooperative and collaborative learning, where learners work on projects together. For example students now research or search for information on the web on their own. Learning has become a more collaborative process than it was before the invention of the computers and the Internet. Collaborative applications (e.g., Prezi, Google Docs, and WeVideo), enable learners to work together on projects. Students no longer need to be at the same location to work together, neither do they need to work on their projects at the same time nor day. By doing so, students remain engaged and independently learn more about themselves, their peers, mobile device and software, and their environments without knowing.

In addition to classroom research use, there are endless applications that enable learning to be fun and easy. According to Churches and Dickens (2012) even the youngest children (pre-kindergartners) who are essentially illiterate can navigate and manipulate the tools on mobile devices. The finger-driven iPad interface is a natural

extension for young and old. It's quick to learn, intuitive, fun and simple (Churches & Dickens, 2012).

The learning process has changed enormously due to technology integration in the curriculum. In a few years to come, every student in most schools will be carrying a mobile device into the classroom and not notebooks. Knowing students' attitudinal dispositions; how they feel and think about technology and learning using mobile devices might be used to improve the whole learning process for future generations of students.

Attitude Progression through the Grades Levels

Due to the fact that this study will evaluate attitudes between grades eight and nine, it is important to review the research to find what change in attitudes should be expected. In doing this study we expected ninth grade students using mobile devices to portray a more positive attitude to technology and learning as they progress through grade levels. The increased use of mobile devices in learning institutions was the informing factor to our expectations. However, his was not the case in most previous research papers used.

This was evident in a study to examine differences by gender and grade level in primary school students' attitudes toward science and technology and to explore relationship between students' attitudes toward science and technology and academic achievement. It was reflected by Akpınar, Yıldız, Tatar, and Ergin, that students' attitudes tend to decline while grade level increase especially at eighth grade level. In another research paper, Frantom, Green and Hoffman also found that students in elementary school tend to have more positive attitudes overall towards learning than

those in high school. Ye, Wells, Talkmitt, and Ren's study investigated and compared American and Chinese secondary school achievement, their attitudes towards science, and other factor influencing science learning. They found out that student's nationality had a much greater effects on science attitudes than gender or grade level. (Akpınar, Yıldız, Tatar, & Ergin, 2009; Frantom, Green & Hoffman, 2002; Ye, Wells, Talkmitt, & Ren, 1998).

CHAPTER 3

METHODOLOGY

This chapter consists of five parts: (a) a description of the participants; (b) the materials and apparatus used; (c) the variables; (d) the procedure and its components; and (e) the instrument.

Participants

The participants included 39 eighth and ninth grade students. There were 21 eighth grade and 18 ninth grade students. The eighth grade participants had an average age of 13 while their ninth grade counterparts had an average age of 14. The treatment group was ninth grade students who had been using laptops for the past year. The ninth grade students had mobile devices around the clock. Eight of them had laptops and ten of them had iPads. They took their mobile devices home in the evening and brought them to school in the morning. Students' placement in their classes was through enrollment at the beginning of the year. The nature of the placement of students in the experimental group was in order of students' enrollment date in the school. The students were not sampled at the beginning of the study, rather, they remained intact during the experiment. It was not known how this could affect the results of the study since the study was not anticipated by the school.

Materials and Apparatus

The questionnaire for Students' Attitudes was a 34-question survey which asked students to use a scale to rate their feelings towards technology and learning. The twenty-seven technology questions used in this survey were based upon an already established

instrument known as *The Children's Attitudes Toward Technology Scale* (Frantom, Green & Hoffman, 2002). The seven questions assessing students' attitudes towards learning were generated by the researcher. The eighth grade students did not have mobile devices. For this reason, question 33 (I have a/an? * - Laptop/iPad) of the questionnaire was removed from their survey since it required students to state the type of device they used.

Variables

Independent Variable

- Mobile Computing Device (laptops, iPads, None)

Dependent Variables

- Attitude towards learning
- Attitude towards technology

It is important to stress that since the beginning of the year, there was a single teacher who taught both of the two ninth grade English classes. For that reason, the two classes used the same English curriculum throughout the year. All English lessons were taught the same way. Students in both classes had the same requirements too. The only variable that was different was the type of mobile computing device used: laptop versus iPad. The devices were split between the two classes, one class using Macintosh laptops and the other using iPads.

In regard to the ninth grade mobile device users versus the eighth grade students who did not have any mobile device the major difference was the use or non-use of mobile device. The ninth grade mobile device users had either the laptops or the iPads

around the clock while the eighth grade students did not have any mobile device at all. However, both the ninth and eighth grade students had access to the desktop computer labs during specific times during the day when they were required to use them. The ninth and eighth grade students had different curricula and teachers. However, the rest of the conditions such as meeting rooms, time spent at school and access to school resources remained the same. Both the ninth and eighth grade students' surveys were administered using a paper copy of the survey.

Procedure

The study was an Ex-Post Facto (Causal Comparative) study. The study collected data through the use of an attitudinal survey (see Appendix F). The survey instrument was comprised of 34 items.

On April 20, 2012, a week before the survey would be administered, the researcher met with study subjects after the approval of the study (see Appendix A) and getting permission from MPLS (see Appendix B). He read a pre-approved script (see Appendix D) that explained the research. The students were then handed permission slips (see Appendix E) for them and their parents to sign and return after 5 days. Parents signed permission slips allowing their children to participate in the survey. The survey was delayed for another two days from the planned date in order to give participants and their parents more time to return their permission slips. When the students returned their permission slips, they personally submitted them to sealed cardboard boxes in their respective rooms.

As the students submitted their permission slips into a sealed box, the teacher did not know which students were allowed to participate in the research and which ones were not. This was to avoid pressure on students to participate in the study. One week later on April 20, 2012, the researcher returned to the classes to administer the surveys to students who returned signed permission slips that allowed them to take the survey. They opened the boxes and then selectively allowed students who had received permission to take the 10-minute survey. Students who did not have permission were allowed to read a book or browse the Internet during that time. Both the eighth and ninth grade students were handed printed copies of the survey whether they used a personal computing device or did not. This was to avoid the introduction of another variable to maintain the equality of the groups in case electronic surveys were used.

Not all of the survey questions were expressed in a way that a high score on the Likert scale indicated a positive attitude towards technology or learning. In order to vary the answers which supported a positive attitude towards technology or learning, some of the statements were worded in a reversed format (flipped) so that a low score indicated a positive attitude (e.g. Learning is not fun if it is challenging.) Therefore, before doing the statistical analysis, the responses for the negative questions were "flipped back" so that higher points indicated a positive attitude (e.g., A score of 2 on a negative question was changed to a 4) assuming that the questions were positive.

Instrument

The Children's Attitudes Towards Technology Scale (CATS) was used for this study. This is a credible instrument used in a number of previous studies. According to

(Frantom et al., 2000), the instrument (CATS) was modeled after the *Children's Attitude Scale* (CAS). Consistent with a number of studies, there was no statistically significant difference in attitude towards technology and learning between study groups. According to Jones and Clarke, students think technology is important in life, good for society and not too difficult for them. Students as well responded that they would like to learn more about technology (Jones & Clarke, 1995).

The modified instrument for this study attempted to measure students' attitudes toward technology and learning. Data was collected through the use of the 34-question attitudinal survey instrument. There were two versions of the instrument: ninth and eighth grade versions. The ninth grade survey instrument was comprised of 34 items while the eighth grade version consisted of 33 items. This instrument was verified for reliability in previous studies. In the Turkish version of *Children's Attitudes Toward Technology Survey (CATTS-T),* a three-factor analysis was performed by Gül Baser, Mutlu, Şendurur, and Şendurur. The factors included "technology interest," "technology resistance" and "technology aptitude." These analyses resulted with Cranach's alphas of 0.68, 0.74, and 0.70 respectively. In this study, the Turkish version of CATTS survey was administrated to 189 seventh grade students (Gül Baser, Mutlu, Şendurur & Şendurur, 2011). Yavuz, in a study developing a technology attitude scale for pre-service chemistry teachers, based the scale on Kathryn Green and Hoffman's version of CATS. Reliability for the 40-items scale used on students aged 13-18 was reported to be alpha = 0.87 (Yavuz, 2005). For these reasons the instrument was considered reliable and credible for this study.

The Children's Attitudes Towards Technology Scale (CATS) has been updated multiple times. According to Hoffman et al., the instrument has been improved over the years through the use of it in studies undertaken to evaluate attitude towards technology-related constructs (Frantom et al., 2002). The most prominent version of the survey is one developed in The Netherlands by Raat in 1985 and administered to 3000 high school students. It was an 80-item Lickert scale questionnaire designed to assess conception and perception of technology (Frantom et al., 2002). The last update of ACTS was in 2002 by Frantom el al., in an empirical study that comprised of a sample of 574 students from ten schools of a rural school district in a Midwest state (Frantom et al., 2002).

The present study's survey is based upon the many years spent evolving the CATS instrument.. A keen examination of the instrument used in this study shows that it is shorter, efficient and an easier instrument for children to use than previous versions. It used a simple Lickert scale. The last question for the ninth grade students was a multiple choice question. The question asked if the students used an iPad or laptop. This question was not included with the eighth grade students.

The reliability for the present version of the test was measured for both the technology and learning question clusters of this instrument. The technology part of the survey yielded a high Cronbach's Alpha (Alpha = 0.909). . This aligns with the original pre/post CATS instrument which rated a Crombach's Alpha of 0.89 and 0.92 respectively with a population of 557 students (Frantom et al., 2002), This shows the present survey to be a credible version of the instrument. On the contrary, the Cronbach's Alpha on the learning items revealed the six items did not have internal consistency (Alpha = 0.031).

When question item 12 (I like easy assignments) was removed, however, the Cronbach's Alpha shot up to 0.557. Therefore, this particular item was not included for further analysis as a group item. This instrument is a better measure of attitude towards technology and learning than any other version of the same instrument developed previously.

CHAPTER 4

RESULTS

This exploratory ex-post facto study was intended to measure the effects of different mobile device interfaces on attitudes of ninth and eighth grade students towards technology and learning. The independent variables were the type of mobile devices the students used (iPad, laptop or none). The dependent variables were the students' attitudes towards technology and learning.

Descriptive Results of the Survey Item

Descriptive statistics were used to explore differences in ninth grade students' attitudes towards learning based upon whether they used iPads or laptops in their classes. This is immediately followed by a comparison of attitudes towards learning between ninth grade students who had mobile devices against eighth grade students who did not have mobile devices for the past year.

While the first set of statistics analyzed students' attitudes towards learning, the last set of descriptive statistics compared ninth grade students' attitudes towards technology. They tested the relationship between students who used iPads and those who used laptops for the school year. They also compared attitudes towards technology between ninth grade students who used mobile devices against eighth grade students who did not have mobile devices.

Table 1 shows the comparison of ninth grade students' attitudes towards learning based upon their use of iPads against those who used laptops for a year. There are six

questions and two of the questions were written in negative formats which have been flipped to align with the other questions.

Table 1:

Ninth Grade Students' Attitudes Towards Learning between iPads and Laptops Users.

Q#		Total			iPad Users			Laptop Users		
		n	M	SD	n	M	SD	n	M	SD
6	*Learning is NOT fun if it is challenging	18	3.75	0.86	10	3.80	0.92	8	4.13	0.64
12	I like easy assignment	18	3.49	0.97	10	3.30	1.06	8	3.25	0.71
17	*I am NOT a good learner:	18	4.47	0.81	10	4.80	0.63	8	4.75	0.46
21	If I make mistakes, I work until I have corrected them	18	4.05	0.69	10	4.30	0.48	8	4.38	0.52
26	If I can't do a problem, I keep trying different ideas	18	3.77	0.63	10	3.80	0.63	8	3.88	0.64

n- Sample size

M- Mean score

MD- Ninth grade Students who used mobile devices.

* - These are questions where the results were written to be negative; therefore the values were flipped to align them with the rest of the positive questions. The values shown have already been flipped.

Table 2 provides a descriptive analysis of the remaining 28 questions which were used to measure ninth grade students' attitudes towards technology. These questions were taken from the CATS test described earlier.

Table 2:

Ninth Grade Students' Attitudes Towards Technology between iPads and Laptops Users.

Q#		Total			iPad Users			Laptop Users		
		n	M	SD	n	M	SD	n	M	SD
2	Technology is very important in life.	18	4.45	0.64	10	4.70	0.74	8	4.38	0.74
3	Working in technology is very creative.	18	4.10	0.72	10	4.40	0.70	8	4.25	0.89
4	Technology makes school more interesting.	18	4.68	0.52	10	4.80	0.42	8	4.50	0.76
5	Girls can do technology as well as boys.	18	4.72	0.60	10	4.90	0.32	8	4.88	0.35
7	People make a lot of money using technology	18	4.18	0.79	10	3.90	0.57	8	4.38	0.92
8	I often get frustrated when using my mobile computer	18	2.38	1.04	10	2.50	1.08	8	2.00	1.41
9	*I positively do NOT want to have a job that uses a lot of technology	18	3.83	1.09	10	4.20	1.14	8	3.63	1.41
10	*Technology is too difficult for me.	18	4.28	.76	10	4.40	0.70	8	4.25	1.04

(Table Continues)

Q#		Total			iPad Users			Laptop Users		
		n	M	SD	n	M	SD	n	M	SD
11	*For students my age, technology is NOT interesting	18	4.49	.82	10	4.70	0.67	8	4.75	0.46
13	I would like to learn more about technology at school	18	3.77	0.78	10	4.00	0.67	8	3.88	0.99
14	I like using computers in my school.	18	4.49	0.82	10	4.80	0.63	8	4.38	1.06
15	*At school you do NOT hear much about technology	18	4.13	0.83	10	4.50	0.53	8	4.13	1.13
16	*I think technology is a little scary	18	4.28	0.94	10	4.30	1.06	8	4.00	1.31
18	*Technology is only for bright people.	18	4.44	0.72	10	4.60	0.52	8	4.38	0.74
19	*Working with computers is boring.	18	4.33	0.77	10	4.20	1.03	8	4.63	0.74
20	I will probably know how to use a computer when I leave school.	18	4.51	0.79	10	4.60	0.70	8	4.38	1.06
22	*I am NOT interested in technology.	18	4.40	0.79	10	4.40	0.70	8	4.63	0.74
23	I feel comfortable working with a computer	18	4.53	0.75	10	4.70	0.67	8	4.63	0.74
24	I like reading books better than computer screens	18	2.72	1.32	10	2.60	1.51	8	3.00	1.41
25	Video games are good for making me think.	18	2.90	1.10	10	2.70	1.06	8	3.00	1.07
27	I like seeing video in class.	18	3.97	0.87	10	4.00	0.94	8	4.13	0.64

(Table Continues)

Q#		Total			iPad Users			Laptop Users		
		n	M	SD	n	M	SD	n	M	SD
28	I learn more when teachers use videos and computers than when they do not.	18	3.87	0.80	10	4.10	0.74	8	3.75	0.89
29	*Technology is unreliable and doesn't usually work when you want it to.	18	4.31	0.77	10	4.30	0.82	8	4.38	0.52
30	I'm relaxed when I work with computers	18	3.97	0.87	10	4.00	0.82	8	4.25	1.04
31	I can do a good job when using computers.	18	4.38	0.59	10	4.30	0.48	8	4.63	0.74
32	I am really used to using technology	18	4.44	0.72	10	4.60	0.52	8	4.63	1.06
34	On average, how many hours a day (in and out of school) are you online using a computer, smart phone, netbook, iPad, or other communicating devices.	18	2.00	1.36	10	2.90	1.10	8	2.63	1.30

Did they really say that they only spent 2 hours on a screen per day?
n- Sample size

M- Mean score

MD- Ninth grade Students who used mobile devices.

* - These are questions where the results were written to be negative; therefore the values were flipped to align them with the rest of the positive questions. The values shown have already been flipped.

Ninth and eighth grade students' attitudes towards learning are represented in Table 3. These descriptive statistics compared mobile device-using ninth grade students against eighth grade students who did not use mobile devices in school.

Table 3:

Ninth and Eighth Grade Students' Attitudes Towards Learning

Q#		Total			Ninth Grade			Eighth Grade		
		n	M	SD	n	M	SD	n	M	SD
6	*Learning is NOT fun	39	3.72	0.86	18	3.94	0.80	21	3.52	0.87
12	I like easy assignment	39	3.49	0.97	18	3.28	0.89	21	3.67	1.02
17	*I am NOT a good learner:	39	4.47	0.81	18	4.78	0.55	21	4.21	0.91
21	If I make mistakes, I work until I have corrected them	39	4.05	0.69	18	4.33	0.49	21	3.81	0.75
26	If I can't do a problem, I keep trying different ideas	39	3.77	0.63	18	3.83	0.62	21	3.71	0.64

n- Sample size

M- Mean score

MD- Ninth grade Students who used mobile devices.

* - These are questions where the results were written to be negative; therefore the values were flipped to align them with the rest of the positive questions. The values shown have already been flipped.

Finally, Table 4 presents a comparison between ninth and eighth grade students' attitudes towards technology.

Table 4:

Ninth and Eighth Grade Students' Attitudes Towards Technology

Q#		Total			Ninth Grade			Eighth Grade		
		n	M	SD	n	M	SD	n	M	SD
2	Technology is very important in life.	39	4.54	0.64	18	4.56	0.70	21	4.26	0.60
3	Working in technology is very creative.	39	4.10	0.72	18	4.33	0.77	21	3.90	0.62
4	Technology makes school more interesting.	39	4.68	0.52	18	4.67	0.59	21	4.70	0.56
5	Girls can do technology as well as boys.	39	4.72	0.60	18	4.89	0.32	21	4.57	0.75
7	People make a lot of money using technology	39	4.18	0.79	18	4.11	0.76	21	4.24	0.83
8	I often get frustrated when using my mobile computer	39	2.38	1.04	18	2.28	1.23	21	2.48.	0.87
9	*I positively do NOT want to have a job that uses a lot of technology	39	3.85	1.09	18	3.94	1.26	21	3.76	0.94
10	*Technology is too difficult for me.	39	4.28	0.76	18	4.33	0.84	21	4.23	0.70
11	*For students my age, technology is NOT interesting	39	4.49	0.82	18	4.72	0.57	21	4.29	0.96

(Table Continues)

Q#		Total			Ninth Grade			Eighth Grade		
		n	M	SD	n	M	SD	n	M	SD
13	I would like to learn more about technology at school	39	3.77	0.78	18	3.94	0.80	21	3.92	0.74
14	I like using computers in my school.	39	4.49	0.82	18	4.61	0.85	21	4.38	0.80
15	*At school you do NOT hear much about technology	39	4.13	0.83	18	4.33	0.84	21	3.95	0.80
16	*I think technology is a little scary	39	4.28	0.94	18	4.17	1.15	21	4.38	0.74
18	*Technology is only for bright people.	39	4.44	0.72	18	4.50	0.62	21	4.38	0.80
19	*Working with computers is boring.	39	4.33	0.77	18	4.39	0.92	21	4.29	0.64
20	I will probably know how to use a computer when I leave school.	39	4.51	0.79	18	4.50	0.86	21	4.52	0.75
22	*I am NOT interested in Technology.	39	4.40	0.79	18	4.50	0.71	21	4.31	0.87
23	I feel comfortable working with a computer	39	4.53	.75	18	4.67	.69	21	4.41	0.80
24	I like reading books better than computer screens	39	2.72	1.32	18	2.78	1.44	21	2.67	1.24
25	Video games are good for making me think.	39	2.90	1.10	18	2.83	1.04	21	2.95	1.16
27	I like seeing video in class.	39	3.97	0.87	18	4.06	0.80	21	3.90	0.94
28	I learn more when teachers use videos and computers than when they do not.	39	3.87	0.80	18	3.94	0.80	21	3.81	0.81

(Table Continues)

Q#		Total			Ninth Grade			Eighth Grade		
		n	M	SD	n	M	SD	n	M	SD
29	*Technology is unreliable and doesn't usually work when you want it to.	39	4.31	0.77	18	4.33	0.69	21	4.29	0.85
30	I'm relaxed when I work with computers	39	3.97	0.87	18	4.11	0.90	21	3.86	0.85
31	I can do a good job when using computers.	39	4.38	0.59	18	4.44	0.62	21	4.33	0.58
32	I'm really used to using Technology	39	4.44	0.72	18	4.61	0.78	21	4.29	0.64
34	On average, how many hours a day (in and out of school) are you online using a computer, smart phone, netbook, iPad, or other communicating devices.	39	2.00	1.36	18	2.78	1.17	21	1.33	1.15

n- Sample size

M- Mean score

MD- Ninth grade Students who used mobile devices. * - These are questions where the results were written to be negative; therefore the values were flipped to align them with the rest of the positive questions. The values shown have already been flipped.

Statistical Analysis

The following hypotheses concerning students' attitudes towards technology and learning were either accepted or rejected based on independent-sample t-tests (Appendix

G). Both primary and secondary analyses of the data were conducted. In the primary analysis, groups of questions were analyzed to find significant differences between student attitudes towards technology and learning. In the secondary analysis, individual questions were analyzed to find out if there existed any significant differences.

Primary Analysis of the T-test Results

In the primary analysis, groups of questions supporting the hypotheses were reviewed.

Hypothesis 1: Hypothesis 1 predicted a statistically significant difference in attitude towards learning between ninth grade students who used personal iPads and those who used personal laptops.

Table 5:

Ninth Grade Students' Attitudes Towards Learning (Mobile Device Users)

	Group	N	M	SD	SEM	ES
Attitudes towards Learning	iPad	10	4.03	.33	0.10	0.5
	Laptop	8	4.19	.29	0.10	

n- Sample size

M- Mean score

SD- Standard deviation

ES- Effect Side (Cohen's d)

SEM- Standard error of mean

Table 5 shows part of an independent sample t-test conducted comparing the mean scores of ninth grade students who used iPads with the ninth grade students who used laptops to establish if there existed a statistically significant difference in attitudes towards learning. The mean for the ninth grade laptop users was higher (M = 4.19, SD = 0.29) than mean for the ninth grade iPad users (M = 4.03, SD = 0.33). An independent samples t-test analysis indicated no statistically significant difference (t (16) = -1.38, p = 0.32) in attitudes towards learning between the means of the two ninth grade student. Therefore hypothesis one was not statistically supported. However, effect size calculations indicated a medium effect size (Cohen's d = 0.5) in favor of the laptop users. Given the low statistical power of the t-test and the potential practical significance of this result, it may be worth replicating this device comparison study with a larger sample. Hypothesis 2: Hypothesis 2 predicted a statistically significant difference in attitudes towards technology between ninth grade students who used personal iPads and those who used personal laptops.

Table 6:

Ninth Grade Students' Attitudes Towards Technology (Mobile Device Users)

	Group	n	M	SD	SEM	ES
Attitude towards Technology	iPad	10	4.20	0.34	0.11	0.2
	Laptop	8	4.14	0.42	0.15	

n- Sample size

M- Mean score

SD- Standard deviation

ES- Effect Side (Cohen's d)

SEM- Standard error of mean

Table 6 reflects results for t-test comparing the mean scores of ninth grade students who used iPads and ninth grade students who used laptops to establish if a statistically significant difference in attitudes towards technology existed. No statistically significant difference was found between the means of the two groups of ninth grade students (t (16) = 0.31, p = 0.76). The means for the ninth grade iPad users (M = 4.20, SD = 0.34) was not statistically significantly different than the mean of the ninth grade laptop users (M = 4.14, SD = 0.42). An effect size calculation (Cohen's d = 0.2) showed a very small effect size. Therefore, there was not found statistical support for Hypothesis 2.

Hypothesis 3: Hypothesis 3 predicted a statistically significant difference in attitudes towards learning between ninth grade students who used mobile computing devices daily and eighth grade students who did not.

Table 7:

Ninth and Eighth Grade Students' Attitudes Towards Learning

	Group	n	M	SD	SEM	ES
Attitude towards Learning	Mobile Device	18	4.10	0.31	0.07	0.9
	No Mobile Device	21	3.83	0.28	0.06	

n- Sample size

M- Mean score

SD- Standard deviation

ES- Effect Side (Cohen's d)

SEM- Standard error of mean

As reflected by Table 7, an independent samples t-test was conducted comparing the mean scores of ninth grade students who used mobile devices and eighth grade students who did not use mobile devices to establish if there was a statistically significant difference in attitudes towards learning. There was a statistically significant difference found between the mean scores of ninth and eighth grade students (t (37) = 2.86, p = 0.007). The mean score for the ninth grade mobile device users (M = 4.10, SD = 0.31) was significantly higher than the mean score of the eighth grade students who did not use mobile devices (M = 3.83, SD = 0.28). An effect size calculation found a large effect size (Cohen's d = 0.9). There was a strong statistical support for Hypothesis 3.

Hypothesis 4: Hypothesis 4 predicted a statistically significant difference in attitudes towards technology between ninth grade students who used portable computing devices daily and eighth grade students who did not.

Table 8:

Ninth and Eighth Grade Students' Attitudes Towards Technology

	Group	n	M	SD	SEM	ES
Attitude towards Technology	Mobile Device	18	4.18	0.37	0.09	0.4
	No Mobile Device	21	4.04	0.36	0.08	

n- Sample size

M- Mean score

SD- Standard deviation

ES- Effect Side (Cohen's d)

SEM- Standard error of mean

An independent-samples t-test (see Table 8 above for results) was conducted comparing the mean scores of ninth grade students who used mobile devices and eighth grade students who did not use mobile devices to establish if there was a statistically significant difference in attitudes towards technology. There were no statistically significant differences in attitudes towards technology between the means of the ninth and eighth grade students (t (37) = 1.16, p = 0.25) found. The mean for the ninth grade

iPad users (M = 4.18, SD = 0.37) was not significantly higher than the mean for eighth grade students who did not use mobile devices (M = 4.04, SD = 0.36). Further analysis calculated a medium effect size (Cohen's d = 0.4). There was no statistical significant support for Hypothesis 4.

Secondary Analysis

As reflected by the primary analysis of the t-test results above, only hypothesis 3 was strongly statistically supported by the t-test results. For this reason, further analysis was not needed for it.

Although Hypothesis 2 did not show a statistical significant difference in the mean scores of ninth grade students, three items (4, 7, and 13) showed a statistical difference.

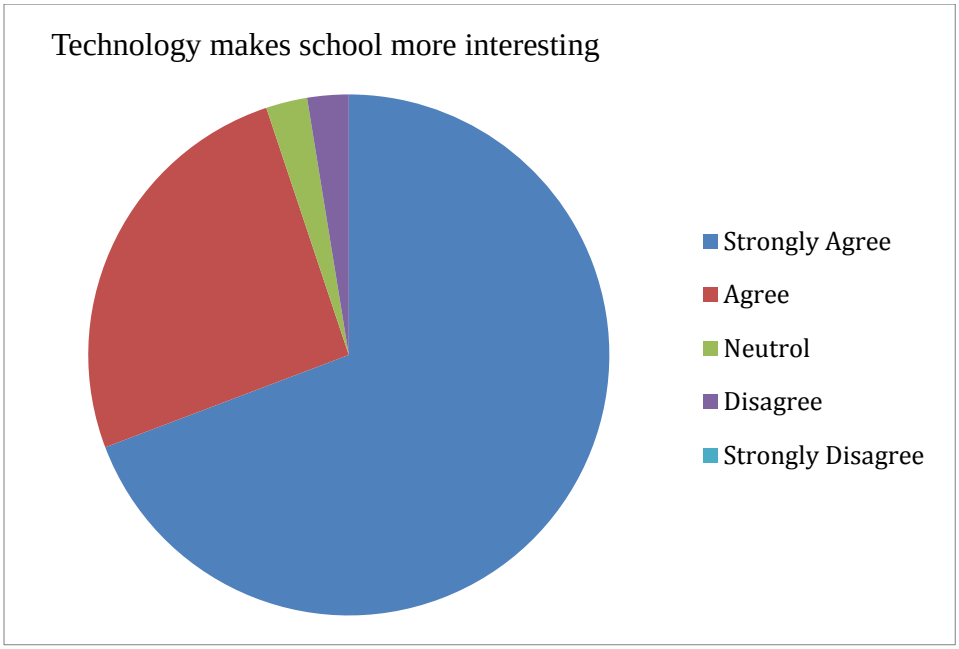

Figure 1. Distribution of responses between iPad and laptop users for item 4

Question 4 (Figure 1 above shows question 4 and response pattern) indicated a statistically significant difference in how interesting students found school (t (17) = -1.07, p = 0.049). The iPad users seemed to strongly agree as reflected in their mean (M = 4.80, SD = 0.42) that technology makes school more interesting, than their laptop counterparts whose mean was (M = 4.50, SD = 0.76) in their responses to the question.

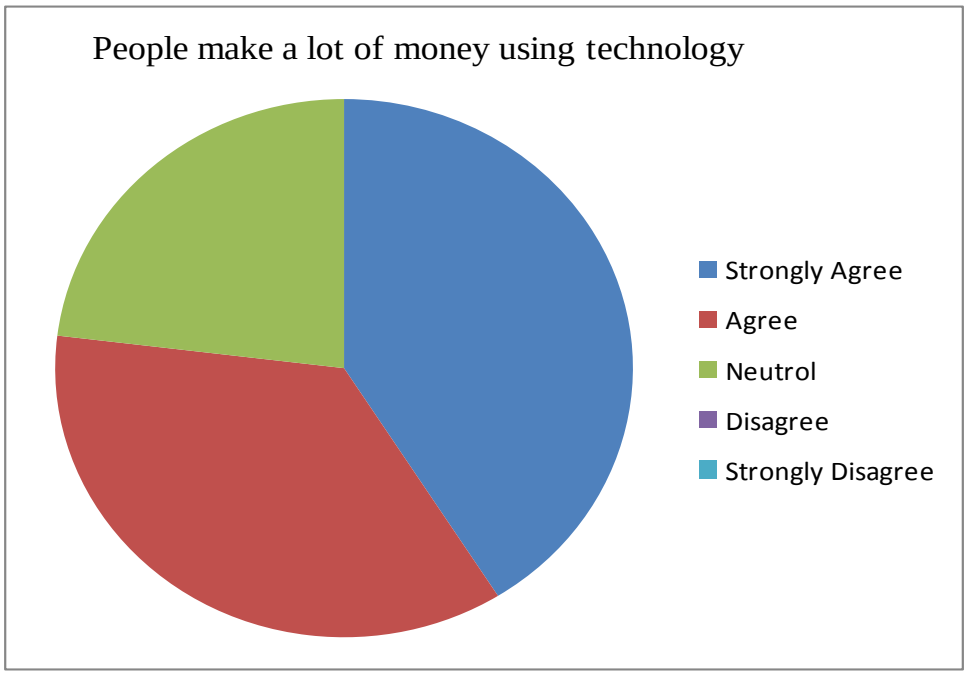

Figure 2. Distribution of responses between iPad and laptop users for item 7

Similarly, an independent samples t-test compared the mean scores of item number 7 (Figure 2 above shows question 7 and response pattern) between ninth grade students who used iPads and those who used laptops. The students using laptops

indicated a significantly greater confidence reflecting people using technology make a lot of money than those using iPads (t (16) = -1.35, p = 0.042) This was shown in the mean score of ninth grade students who used laptops which was significantly higher (M = 4.38, SD = 0 .92) than the mean score of the ninth grade students who used iPads (M = 3.90, SD = 0.57). This indicated that the iPad users believed that they would make a lot of money if they worked in technology field compared to their laptop counterparts.

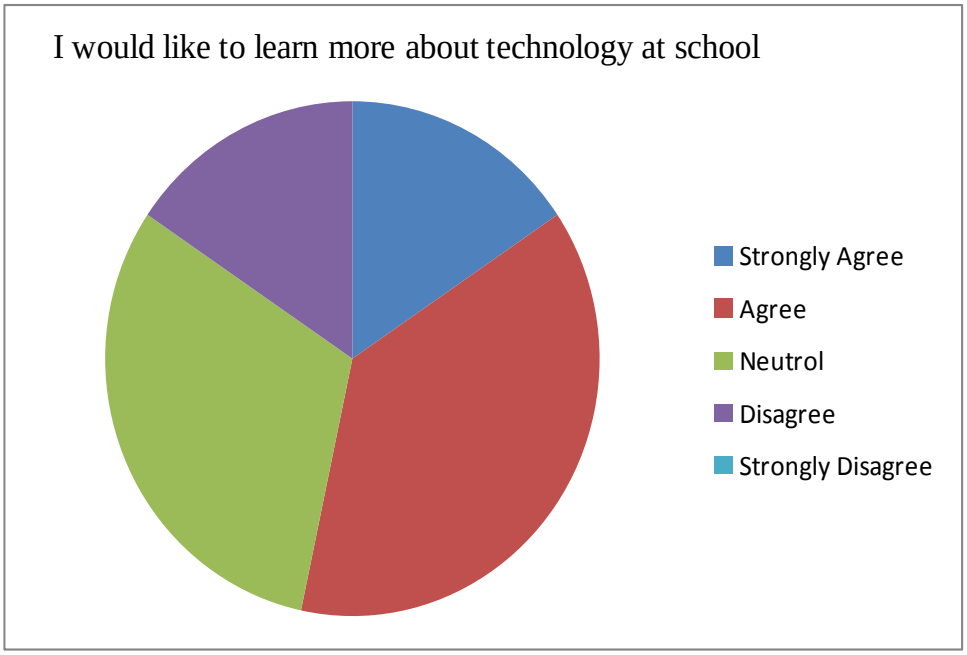

Figure 3. Distribution of responses between iPad and laptop users for item 13

In the same vein, an independent sample t-test compared the mean scores of item number 13 (Figure 3 above shows question 13 and response pattern) between ninth grade students who used iPads and ninth grade students who used laptops. The iPad users showed a significantly higher interest in learning more about technology at school (t (16)

= 0.32, p = 0.038) than the laptop users. The mean score for ninth grade students who used iPads was significantly higher (M = 4.00, SD = 0.67) than the mean score of the ninth grade students who used laptops (M = 3.88, SD = 0.99). This indicates that the iPad users were significantly interested in learning more about technology than those using laptops.

Hypothesis 4 was supported in two questions (question 3 and 5) examining students' attitudes towards technology. The ninth grade mobile device users tended to believe in creativity and gender equality when it comes to using technology. An independent samples t-test compared the mean scores of item 3 (Working in technology is very creative) between ninth grade students and eighth grade students. The study revealed that ninth grade students who used mobile devices were in greater agreement with question 3 than their eighth grade students who did not use mobile devices. For this item, the mean score of ninth grade students who used mobile devices was statistically significantly higher (M = 4.33, SD = 0.77) than the mean score of the eighth grade students who did not use mobile devices (M = 3.90, SD = 0.63). This indicated that ninth grade mobile device users felt rather more creative in their work than eighth grade students that did not use mobile devices.

Finally, an independent samples t-test revealed the mean scores of item number 5 (Girls can do technology as well as boys) indicated that mobile device-using ninth grade students were in significantly higher agreement with this equality statement than their eighth grade counterparts (t (37) = 1.67, p = 0.05). The mean score for the ninth grade

students on this item was significantly higher (M = 4.89, SD = 0.32) than the mean score of the eighth grade students (M = 4.57, SD = 0.75).

CHAPTER 5

DISCUSSION

An independent samples t-test was run pertaining to the main questions outlined below relating to the survey. The four questions to be answered were:

1. Are there any differences in attitudes towards learning between ninth grade students who use personal iPads and those who use personal laptops?
2. Are there any differences in attitudes towards technology between ninth grade students who use personal iPads and those who use personal laptops?
3. Are there any differences in attitudes towards learning between ninth grade student who use portable computing devices daily and eighth grade students who do not?
4. Are there any differences in attitudes towards technology between ninth grade student who use portable computing devices and eighth grade students who do not?

Hypothesis 3 was the only hypothesis that showed statistical power. The ninth grade users had a significantly more positive attitude towards learning than the eighth graders. It should be noted that both of the groups indicated positive attitudes towards learning. The eighth graders averaged 3.8 and the ninth graders averaged 4.1. It's just that the ninth graders were more positive than the eighth graders. This increased positive attitude of higher grade students is contrary to the studies that have shown that motivation to learning over the periods of middle to high school decreased as students advance to high grades (Akpınar, et al., 2009; Frantom, et al., 2002; Ye, et al., 1998). The study did

not establish the cause of this increase in motivation, but it may have something to do with the availability of technology.

While only hypothesis 3 showed statistical power supported by the analysis, secondary analysis uncovered some independent items that indicated differences between the groups for hypotheses 1, 2 and 4. Secondary analysis showed that ninth grade laptop users put greater value on technology than their iPad counterparts. Similarly, the ninth grade mobile device users valued using technology at school more than the eighth grade non-mobile device users. There was no evidence to show any statistically significant differences in attitudes toward technology between any of the groups.

The researcher postulated that the mobile devices' interface could affect students' overall impression of technology which could then affect their attitudes towards learning itself. This attitude about the interface could be affected by ease of use, general perception and capacity. The iPad interface provides a simple, touch-screen interface between the user and computer. The students seem to have developed a positive perception of the devices based upon the hyped performance described through advertisement. The devices have a reasonable storage and processing capacity but they have access to the Internet which provides an almost endless amount of information.

As relates to hypothesis 1, primary as well as secondary analysis did not discover any statically significant differences in attitudes' towards learning between iPad and laptop users. A repeat of the same study with a larger sample size is likely to produce different results as indicated by the effect size (Cohen's $d = 0.5$)

Although there was no support for Hypothesis 2, a secondary analysis found significant differences in how some of the survey questions were answered. The responses to survey questions 4, 7 and 13 reflected significant statistical differences in attitude towards technology between the two ninth grade classes. A calculation of the effect size was (Cohen's d = 0.2). Although this effect size was too small, the replication of the study using a larger sample size is advised.

Relating to question number 4 (Technology makes school more interesting), the iPad users strongly felt that technology makes schools more interesting than the laptop users. In question 7 (People make a lot of money using technology) the iPad users felt more strongly than the laptop users that people who use technology in their lives make a lot of money. As reflected by survey item 7, students who used iPads indicated that they would like to learn more about technology as corroborated by survey question 13 (I would like to learn more about technology at school.) responses unlike those who used laptops. It appears that the iPad users believed that being an expert in technology leads to jobs that pay well, thus they want to learn more about technology.

When asked if they liked easy assignments, both ninth and eighth grade students seemed to agree that it was OK to have easy assignments but the mean of 3.49 only showed a slight interest in easy assignments. Same is reflected with item 26, "If I can't do a problem, I keep trying different ideas." However, both grades felt totally different when it came to the rest of the learning items especially three items: "I like to learn," "I am NOT a good learner," and "If I make mistakes, I work until I have corrected them." Ninth grade students strongly agreed with these items whereas the eighth grade students

strongly disagreed with them. As related to this hypothesis, the differences were distinct. When asked, "Learning is not fun if it is challenging," ninth grade students disagreed while eighth grade student agreed. The statistical power (t (37) = 2.86, p = 0.007) and the large effect size (Cohen's d = 0.9) is a strong indication that is repeated with larger samples the result would be the same each time.

Pertaining to the ninth and eighth grade students' attitudes towards technology (Hypothesis 4), both primary and secondary analysis failed to uncover any statistically significant differences in attitude towards technology between ninth grade students who used mobile devices and eighth grade students who did not use mobile devices. The use of a small sample size might have been the cause. The medium effect size (Cohen's d = 0.4) predicts that the use of a larger sample size in future studies might result positively.

Limitations

The major limitation of the study was sample size. Due to the small size of the school, the number of students per class was low. The study had a sample population of 39 (n=39 for sample size). The results may have been more dramatic if the sample size for the study was larger.

The study could have benefited from a larger quantity of background empirical studies. Since this is a fairly new area of study, this was a major limitation. There was a lack of empirical studies for reference. Since mobile device technology is fairly new in schools, not much study has been done in this area. In a well-informed research report much has to be drawn from previous research done by professionals in the field on the

same topic. Future studies would benefit from peer-reviewed literature, which was difficult to come by in the process of this study.

There might have been cross-over effects though minimal, as well, since eighth grade students had the desktops at their disposal during school hours that might have affected the outcome for hypotheses 1, 2 and 4. At the same time, some students had desktops at their homes and so they may not have identified a big difference between the mobile devices as pertain to attitudes towards technology. The desktop factor could not be controlled. On the other hand, the effects of the desktops might have no consequences on neither student's attitudes towards technology nor learning since the study focused on mobile devices (laptops and iPads) interfaces. These two devices are quite different than desktops as explained in mobile device section of the introduction.

Recommendations

This study is important due to the trends in the education sector with the advent of mobile devices in classes. It is recommended that the study be repeated using a large enough sample size to determine the attitude of students towards technology and learning.

Although using a credible and tested instrument is a good idea, and although the addition of the learning portion of the instrument was a good idea, the items measuring learning attitude need to be reformulated to improve their credibility. The number of questions in the learning portion of the instrument needs to be increased in number, refined and tested to insure high internal reliability of the items.

Although the technology items are good, some of them need to be reformulated to reflect present and future developments in technology. This will enable learners to be encouraged to participate in the survey more to boost the sample size numbers.

Conclusion

This study investigated the relationship between students' attitudes toward technology and learning and the mobile device (iPad/laptop) interface they used (or didn't use). The preliminary results indicated that there was a statistically significant difference in attitudes towards learning between ninth grade and eighth grade students. This is contrary to the findings in previous studies. The question is "why are the ninth grade students more positive about learning than eighth graders?" Was technology the difference, or was it the teacher, the subject or the learning environment? The researcher recommends these questions be the basis for further researched.

The ninth-grade iPad students tended to show a more positive attitude towards using technology and their futures in using technology than the laptop users. This should inform administrative decisions about using tablets versus keyboards for one-to-one initiatives in school. This study did not examine the facility of using these interfaces, only the attitudes of students using them. Further studies might investigate students' perceptions of ease-of-use of the interfaces and how it might relate to achievement.

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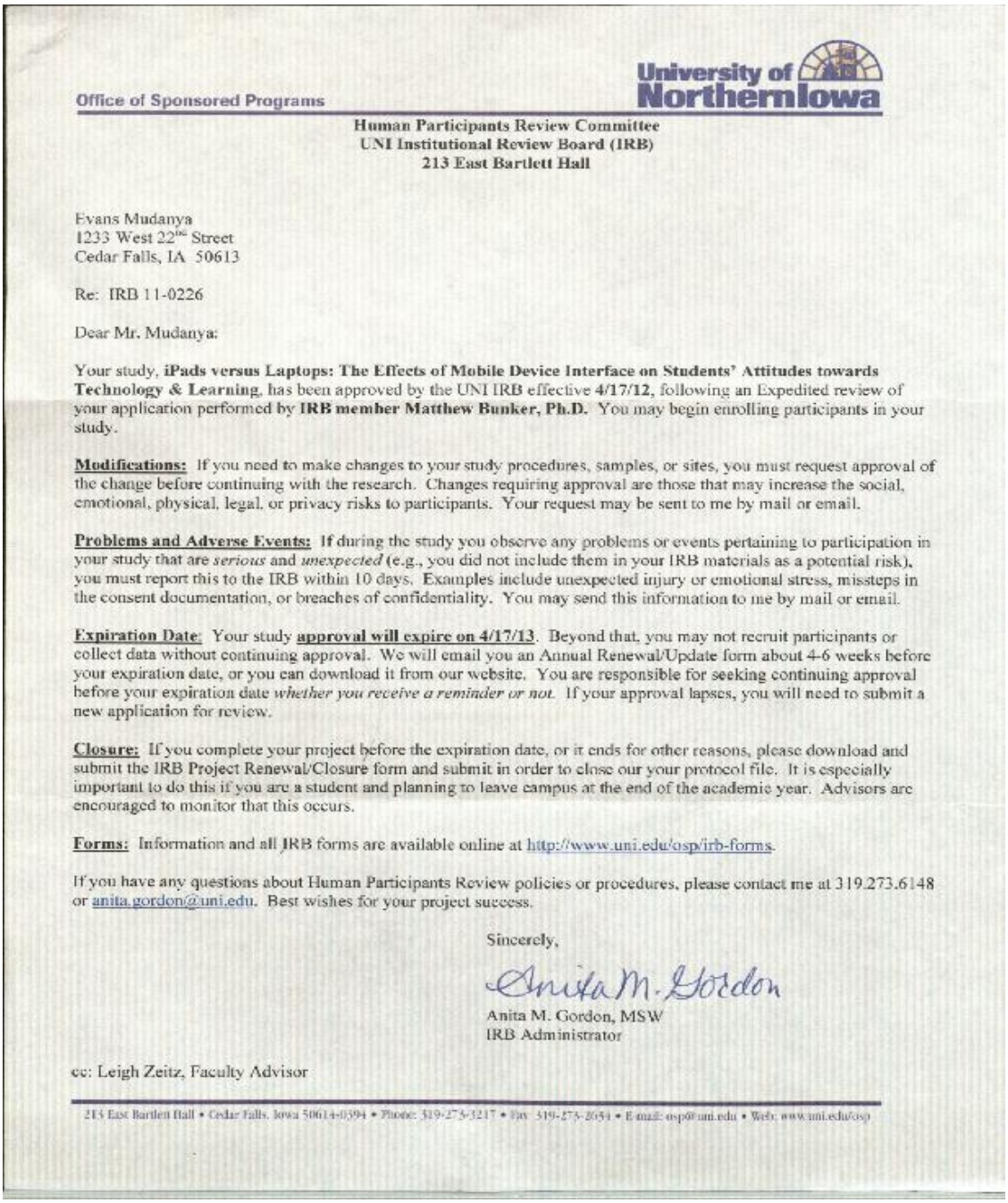
APPENDIX A

UNI INSTITUTE REVIEW BOARD (IRB) RESEARCH APPROVAL



Office of Sponsored Programs

University of Northern Iowa

Human Participants Review Committee
UNI Institutional Review Board (IRB)
213 East Bartlett Hall

Evans Mudanya
1233 West 22nd Street
Cedar Falls, IA 50613

Re: IRB 11-0226

Dear Mr. Mudanya:

Your study, **iPads versus Laptops: The Effects of Mobile Device Interface on Students' Attitudes towards Technology & Learning**, has been approved by the UNI IRB effective **4/17/12**, following an Expedited review of your application performed by **IRB member Matthew Bunker, Ph.D.** You may begin enrolling participants in your study.

Modifications: If you need to make changes to your study procedures, samples, or sites, you must request approval of the change before continuing with the research. Changes requiring approval are those that may increase the social, emotional, physical, legal, or privacy risks to participants. Your request may be sent to me by mail or email.

Problems and Adverse Events: If during the study you observe any problems or events pertaining to participation in your study that are *serious* and *unexpected* (e.g., you did not include them in your IRB materials as a potential risk), you must report this to the IRB within 10 days. Examples include unexpected injury or emotional stress, missteps in the consent documentation, or breaches of confidentiality. You may send this information to me by mail or email.

Expiration Date: Your study **approval will expire on 4/17/13**. Beyond that, you may not recruit participants or collect data without continuing approval. We will email you an Annual Renewal/Update form about 4-6 weeks before your expiration date, or you can download it from our website. You are responsible for seeking continuing approval before your expiration date *whether you receive a reminder or not.* If your approval lapses, you will need to submit a new application for review.

Closure: If you complete your project before the expiration date, or it ends for other reasons, please download and submit the IRB Project Renewal/Closure form and submit in order to close our your protocol file. It is especially important to do this if you are a student and planning to leave campus at the end of the academic year. Advisors are encouraged to monitor that this occurs.

Forms: Information and all IRB forms are available online at http://www.uni.edu/osp/irb-forms.

If you have any questions about Human Participants Review policies or procedures, please contact me at 319.273.6148 or anita.gordon@uni.edu. Best wishes for your project success.

Sincerely,

Anita M. Gordon

Anita M. Gordon, MSW
IRB Administrator

cc: Leigh Zeitz, Faculty Advisor

213 East Bartlett Hall • Cedar Falls, Iowa 50614-0394 • Phone: 319-273-3217 • Fax: 319-273-2654 • E-mail: osp@uni.edu • Web: www.uni.edu/osp

APPENDIX B

PERMISSION TO CONDUCT RESEARCH AT MPLS

PRICE LABORATORY
NU High School

University of Northern Iowa

April 17, 2012

Evans Mudanya
Curriculum and Instruction

Dear Evan Mudanya,

Malcolm Price Laboratory School is pleased to collaborate with you on your project "iPads versus Laptops: The Effects of Mobile Device Interface on Students' Attitudes towards Technology and Learning." Since we are in the process of documenting our own research on the 1 to1 initiative we expect that your data, analysis, and completed thesis be available for our use to incorporate these findings into our research articles. We will correctly attribute this research data to you in our papers.

We understand that participating in this research will include surveying students on their opinions/ attitudes towards technology and learning. We had ample opportunities to discuss the research with you and ask for clarifications. Furthermore, we understand the PI and key personnel for this project will maintain confidentiality of all research participants in all phases of this project.

According to our agreement, project activities will be carried out as described in the research plan reviewed and approved by the University of Northern Iowa Institutional Review Board.

We look forward to working with you, and please consider this communication as our Letter of Cooperation. Please send me a digital copy of your thesis upon completion

Sincerely,

Lyn Le Countryman
Interim Director Malcolm Price Laboratory School
legislated as Iowa's Research and Development School

1901 Campus Street • Cedar Falls, Iowa 50613-3593 • Phone 319- 273-2614 • Fax 319-273-6457

APPENDIX C

SOCIAL AND BEHAVIORAL RESEARCH CURRICULUM COMPLETION REPORT

CITI Collaborative Institutional Training Initiative

Social & Behavioral Research Curriculum Completion Report
Printed on 3/31/2012

Learner: Evans Mudanya (username: evansmudanya)
Institution: University of Northern Iowa
Contact Information 1233 W 22nd St.
Cedar Falls, Iowa 50613 USA
Department: Curriculum and Instruction
Phone: 3194299015
Email: mudash@uni.edu

Social & Behavioral Research:

Stage 1. Basic Course Passed on 03/31/12 (Ref # 7720469)

Required Modules	Date Completed	Score
Belmont Report and CITI Course Introduction	03/31/12	3/3 (100%)
Students in Research	03/31/12	10/10 (100%)
History and Ethical Principles - SBR	03/31/12	4/4 (100%)
The Regulations and The Social and Behavioral Sciences - SBR	03/31/12	5/5 (100%)
Assessing Risk in Social and Behavioral Sciences - SBR	03/31/12	5/5 (100%)
Informed Consent - SBR	03/31/12	5/5 (100%)
Privacy and Confidentiality - SBR	03/31/12	5/5 (100%)
Research with Children - SBR	03/31/12	4/4 (100%)
University of Northern Iowa	03/31/12	no quiz
Elective Modules	**Date Completed**	**Score**
Records-Based Research	03/31/12	2/2 (100%)
Research in Public Elementary and Secondary Schools - SBR	03/31/12	4/4 (100%)
Internet Research - SBR	03/31/12	4/4 (100%)
Vulnerable Subjects - Research Involving Workers/Employees	03/31/12	3/4 (75%)

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

Return

APPENDIX D

PERMISSION SCRIPT

Pre-approved Script

Department of Curriculum and Instruction

University of Northern Iowa

University of Northern Iowa
Human Participants Review
Instructions to Participants

In this survey, we want to find out what YOUR opinion about technology is. By technology we mean Laptop, iPad, their interfaces and how you interact with the computing devices. There is no right or wrong answers so just mark the number that comes closest to what you think.

Please feel free to stop at any time if you feel you can't continue.
Please take your time to complete the survey questions with the answer that first comes to your mind. Remember, it is important that you answer the questions truthfully and to the best of your ability. Your name will not be used at any time, and your answers will not be available to anyone else, beyond the researcher.

This survey will enable us know how you feel about learning here at MWHS. It will also enable us know how you feel about the Technology you use in classrooms and at home. The result of this survey will be used to determine the best approach the teachers should take to improve your learning experience.

Although your participation in the survey is essential to improving the Technology and learning experiences in this school, your participation in voluntary. After start the survey and you feel that you cannot finish it, feel free to hand in your survey and read a book or surf the internet. At any point in the survey you are free to stop if you feel comfortable finishing the survey.

For those that are not taking the survey, you are allowed to read a book of your choosing or surf the web. Please stay quiet to give the rest ample time to do the survey.

APPENDIX E

PERMISSION SLIPS

Parental Permission Slips

Department of Curriculum and Instruction

HUMAN PARTICIPANTS REVIEW
PARENTAL PERMISSION

(Letter for Participant's Parents)

Dear Parents;

Your child has been invited to participate in a research project conducted through the College of Education, Curriculum and Instruction Department of The University of Northern Iowa. The research will involve your child completing one 10-minute survey in class. The University requires that you give your signed agreement to allow your child to participate in this project. The following information is provided to help you make an informed decision whether or not to participate.

Purpose: The purpose of the study is to identify students' Attitudes towards Technology and learning . This study will compare these Attitudes based upon whether they use an iPad, a Laptop or no computer in their English class.

Procedures: This study will involve learners completing a single paper-based survey. The survey is composed of 34 short questions with a point scale (1 - 5) to indicate a student's degree of agreement with the various questions. On the survey, a statement will be made and the students will indicate their response to each item using a scale: 1, strongly disagree; 2 disagree; 3, neutral; 4, agree; 5, strongly agree.

Initially, the researcher will meet with the students and explain the study. This will be read from a pre-approved script. The students will then be handed permission slips for their parents to sign and return to school. These slips will indicate whether or not their parents have given permission to participate in the study. When the students return their permission slips, they will place them in sealed cardboard boxes in the room. The teacher will have no way to know which students will be allowed to participate in the research and which will not.

One week later, the researcher will return to each of the three participating classes to administer the surveys. He will open the boxes and then selectively allow students who have received permission to take the short 10-minute survey. The researcher will collect the surveys. No one else except the researcher's advisor, Dr. Leigh Zeitz, will view the surveys. After results have been tabulated, all of the surveys will be shredded.
No videotaping or picture taking will be involved.

Discomfort and Risks: There may be at best very minimal risks in terms of physical, psychological, social, legal, and economic risk(s) or cost(s) resulting from the project that may cause discomfort, burden, and inconvenience to the participants, parents or teachers. The risks to participation however are similar to those experienced in day-to-day life and at this particular time are not anticipated. Students who do not have permission to complete this anonymous survey will be allowed to read a book or do homework while waiting.

Benefits: Their will be no compensation either to the school, teacher, parent or participants as a result of administering the survey.

Confidentiality: Information obtained during this study which might identify your child will be kept strictly confidential. The summarized findings with no identifying information may be published in an academic journal or presented at a scholarly conference.

Right to Refuse or Withdraw: Your child's participation is completely voluntary. He or she is free to withdraw from participation at any time or to choose not to participate at all, and by doing so, your child will not be penalized in any way.

Questions: If you desire information in the future regarding your child's participation or the study, you can contact (Evans Mudanya) at 319-429-9015 or (if necessary) the project investigator's faculty advisor Dr. Leigh Zeitz at the UNI Department of Curriculum and Instruction at 319-273-3249. You can also contact the office of the Human Participants Coordinator, University of Northern Iowa, at 319-273-6148, for answers to questions about rights of research participants and the participant review process."

Agreement:

I am fully aware of the nature and extent of my child's participation in this project as stated above and the possible risks arising from it. I hereby agree to allow my son/daughter to participate in this project. I have received a copy of this form.

_____ _____
(Signature of parent/legal guardian) (Date)

_____
(Printed name of parent/legal guardian)

_____
(Printed name of child participant)

_____ _____
(Signature of investigator) (Date)

_____ _____
(Signature of instructor/advisor) (Date)

[NOTE THAT ONE COPY OF THE ENTIRE CONSENT DOCUMENT (NOT JUST THE AGREEMENT STATEMENT) MUST BE RETURNED TO THE PI AND ANOTHER PROVIDED TO THE PARTICIPANT. SIGNED CONSENT FORMS MUST BE MAINTAINED FOR INSPECTION FOR AT LEAST 3 YEARS]

Students Permission Slip

Department of Curriculum and Instruction

University of Northern Iowa

Human Participants Review
Informed Assent
(Child/Minor Assent Form)

Project Title: (iPads versus Laptops: The Effects of Mobile Devices on Students' Attitudes
Towards Technology and Learning)

Name of Principal Investigator(s): Evans Mudanya

I, _____, have been told that one of my parents/guardians has given his/her permission for me to participate in a project about my Attitudes towards Technology and Learning. This study will compare the Attitudes of students based upon whether they use an iPad, a Laptop or no computer in my English class. I understand that my total involvement in this study is completing a 10-minute survey which I will complete in class. My participation in this study will be completely anonymous.

I understand that my participation is voluntary. I have been told that I can stop participating in this project at any time. If I choose to stop or decide that I do not want to participate in this project at all, nothing bad will happen to me. My grade will not be affected in any way.

_____ _____
Name Date

618 Schindler Education Center • Cedar Falls, Iowa 50614-0606 • Phone: 319-273-2167 • Fax: 319-273-5886 Website: http://www.uni.edu/coe/ci/

APPENDIX F

ATTITUDINAL SURVEY

This survey will ask you questions about your Attitude towards Technology and learning . Please read each statement below and circle the number in the column that best represents how you feel about the statement.

Do you agree or disagree or anywhere along the scale.

(1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4= Agree; 5= Strongly Agree)

SN.	Question	Answer				
		SD	D	N	A	SA
1	I like to learn. *	1	2	3	4	5
2	Technology is very important in life.	1	2	3	4	5
3	Working in technology is very creative.	1	2	3	4	5
4	Technology makes school more interesting.	1	2	3	4	5
5	Girls can do Technology as well as boys.	1	2	3	4	5
6	Learning is NOT fun if it is challenging.	1	2	3	4	5
7	People make a lot of money using Technology.	1	2	3	4	5
8	I often get frustrated when using my mobile computer	1	2	3	4	5
9	I positively do NOT want to have a job that uses a lot of Technology.	1	2	3	4	5
10	Technology is too difficult for me.	1	2	3	4	5
11	For student my age, Technology is NOT interesting.	1	2	3	4	5
12	I like easy assignments.	1	2	3	4	5
13	I would like to learn more about Technology at school.	1	2	3	4	5
14	I like using computers in my school.	1	2	3	4	5
15	At school, you do NOT hear much about Technology.	1	2	3	4	5
16	I think Technology is a little scary.	1	2	3	4	5
17	I am NOT a good learner.	1	2	3	4	5
18	Technology is only for bright people.	1	2	3	4	5
						(Attitudinal Survey continues)

SN.	Question	Answer				
		SD	D	N	A	SA
19	Working with computers is boring.	1	2	3	4	5
20	I will probably know how to use a computer when I leave school.	1	2	3	4	5
21	If I make mistakes, I work until I have corrected them.	1	2	3	4	5
22	I am NOT interested in Technology.	1	2	3	4	5
23	I feel comfortable working with a computer.	1	2	3	4	5
24	I like reading books better than computer screens.	1	2	3	4	5
25	Video games are good for making me think.	1	2	3	4	5
26	If I can't do a problem, I keep trying different ideas.	1	2	3	4	5
27	I like seeing video in class.	1	2	3	4	5
28	I learn more when teachers use videos and computers than when they do not.	1	2	3	4	5
29	Technology is unreliable and doesn't usually work when you want it to.	1	2	3	4	5
30	I'm relaxed when I work with computers.	1	2	3	4	5
31	I can do a good job when using computers.	1	2	3	4	5
32	I'm really used to using Technology.	1	2	3	4	5
33	I have a/an? *	Laptop iPad				
34	On average, how many hours a day (in and out of school) are you online using a computer, smart phone, netbook, iPad, or other communicating devices?	0-2 hours 2-4 hours 4-6 hours 6-8 hours 8-10 hours 10+ hours				

APPENDIX G

STATISTICAL ANALYSIS OF T-TEST RESULTS

Table G1

Ninth grade Attitude Towards Learning T-test Examination

	M	**SD**	**t**	**Df**	**P**	**95% CI**
	iPad(Laptop)	**iPad(Laptop)**				
Q1L	4.20(4.75)	.632(.463)	-2.054	16	.503	[-1.118, .018]
Q6L	3.8(4.13)	.919(.641)	-.847	16	.340	[-1.14,.489]
Q12L	3.30(3.25)	1.059(.707)	.114	16	.182	[-.878,.978]
Q17L	4.80(4.75)	.632(.463)	.187	16	.939	[-.518,.618]
Q21L	4.30(4.38)	.483(.518)	-.317	16	.550	[-.576,.426]
Q26L	3.80 (3.88)	.632(.641)	-.249	16	.828	[-.715,.565]

MD- Ninth grade Students that used mobile devices.

NMD- Eighth grade students that did not use mobile devices

t- t- Score for equality of mean (t statistic)

df- Degree of confidence

95% CI- 95 percent confidence interval

Table G2

Ninth grade Attitude Towards Technology T-test Examination

	M	**SD**	**t**	**df**	**P**	**95% CI**
	iPad(Laptop)	**iPad(Laptop)**				
Q2T	(4.70)4.38	.675(.744)	.970	16	.455	[-.385,1.035]
Q3T	4.40(4.25)	.700(.886)	.402	16	.360	[-.641,.941]
Q4T	4.80(4.50)	.422(.756)	1.069	16	.049	[-.295,.895]
Q5T	4.90(4.88)	.316(.354)	.158	16	.756	[-.310,.360]
Q7T	3.90(4.38)	.568(.916)	-1.352	16	.042	[-1.220,.270]
Q8T	2.50(2.00)	1.080(1.414)	.852	16	.775	[-.744,1.744]
Q9T	4.20(3.63)	1.135(1.408)	.961	16	.582	[-.694,1.844]
Q10T	4.40(4.25)	.699(1.035)	.367	16	.526	[-.717,1.017]
Q11T	4.70(4.75)	.675(.463)	-.178	16	.556	[-.645,.545]
Q13T	4.00(3.88)	.667(.991)	.320	16	.038	[-.704,.954]
Q14T	4.80 (4.38)	.632(1.061)	1.058	16	.142	[.427,1.277]
Q15T	4.50(4.13)	.527(1.126)	.938	16	.075	[-.473,1.223]
Q16T	4.30(4.00)	1.059(1.309)	.538	16	.618	[-.882, 1.482]
Q18T	4.60(4.38)	.516(.744)	-.757	16	.202	[-.405, .855]
Q19T	4.20(4.63)	1.033(.744)	-.976	16	.361	[-1.348, .498]
Q20T	4.60(4.38)	.700(1.061)	.542	16	.379	[-.626,1.106]
Q22T	4.40(4.63)	.500(.744)	-.660	16	.832	[-.948,.498]

(Table continues)

	M iPad(Laptop)	SD iPad(Laptop)	t	df	P	95% CI
Q23T	4.70(4.63)	.675(.744)	.224	16	.700	[-.635,.785]
Q24T	2.60(3.00)	1.506(1.414)	-.575	16	.633	[-1.874,1.074]
Q25T	2.70(3.00)	1.06(1.069)	-.595	16	.597	[-1.370,.770]
Q27T	4.00(4.13)	.943(.641)	-.320	16	.575	[-.954,.704]
Q28T	4.10(3.75)	.738(.886)	.915	16	.321	[-.460,1.160]
Q29T	4.30(4.38)	.823(.518)	-.224	16	.109	[-.785,.635]
Q30T	4.00(4.25)	.817(1.035)	-.574	16	.594	[-1.174,.674]
Q31T	4.30(4.63)	.483(.744)	-1.121	16	.368	[-.939,.289]
Q32T	4.60(4.63)	.516(1.061)	-.066	16	.495	[-.831,.781]
Q34T	2.90(2.63)	1.101(1.302)	.486	16	.702	[-.925,1.475]

Table G3

Ninth/Eighth Grades Attitude Towards Learning T-test Examination

	M	**SD**	**t**	**df**	**P**	**95% CI**
	MD(N.M.D)	**M.D(N.M.D)**				
Q1L	4.44(4.05)	.616(.740)	1.802		.928	[-.050,.843]
Q6L	3.94(3.52)	.802(.873)	1.557		.212	[-.127,.968]
Q12L	3.28(3.67)	.895(1.02)	-1.258		.168	[-1.015,238]
Q17L	4.78(4.21)	.548(.910)	2.302		.070	[.068,1.064]
Q21L	4.33(3.81)	.485(.750)	2.541		.098	[.106,.941]
Q26L	3.83(3.71)	.618(.644)	.586		.483	[-.292,.530]

Table G4

Ninth/Eighth Grades Attitude Towards Technology T-test Examination

	M	**SD**	**t**	**df**	**P**	**95% CI**
	MD(N.M.D)	**M.D(N.M.D)**				
Q2T	4.55(4.52)	.705(.602)	.152	37	.608	[-.392,.455]
Q3T	4.33(3.90)	.767(.625)	1.923	37	.033	[-.023,.880]
Q4T	4.67(4.70)	.594(.458)	-.194	37	.354	[-.374,.309]
Q5T	4.89(4.57)	.323(.746)	1.672	37	.001	[-.067,.702]
Q7T	4.11(4.24)	.758(.831)	-.495	37	.319	[-.647,.393]
Q8T	2.28(2.48)	1.23(.873)	-.588	37	.143	[-.882,.485]
Q9T	3.94(3.76)	1.258(.944)	.517	37	.109	[-.533,.898]
Q10T	4.33(4.24)	.840(.700)	.386	37	.533	[-.404,.595]
Q11T	4.72(4.29)	.575(.956)	1.691	37	.051	[-.087, .960]
Q13T	3.94(3.62)	.802(.740)	1.317	37	.978	[-.180,.826]
Q14T	4.61(4.38)	.850(.805)	.868	37	.794	[-.307,.768]
Q15T	4.33(3.95)	.840(.805)	1.444	37	.498	[-.154,.915]
Q16T	4.17(4.38)	1.150(.740)	-.702	37	.091	[-.833,.405]
Q18T	4.50(4.38)	.618(.805)	.511	37	.126	[-.353,.591]
Q19T	4.39(4.29)	.916(.644)	.411	37	.135	[-.405, .611]
Q20T	4.50(4.52)	.857(.750)	-.093	37	.825	[-.545,.497]
Q22T	4.50(4.31)	.707(.868)	.737	37	.761	[-.330,.709]

(Table Continues)

	M MD(N.M.D)	SD M.D(N.M.D)	t	df	P	95% CI
Q23T	4.67(4.41)	.686(.800)	1.082	37	.432	[-.228,.749]
Q24T	2.78(2.67)	1.437 (1.238)	.259	37	.546	[-.757,.979]
Q25T	2.83(2.95)	1.043(1.161)	-.334	37	.907	[-.840,.602]
Q27T	4.06(3.90)	.802(.944)	.533	37	.647	[-.423,.725]
Q28T	3.94(3.81)	.802(.814)	.520	37	.647	[-.391,.661]
Q29T	4.33(4.29)	.686(.845)	.191	37	.511	[-.457,.553]
Q30T	4.11(3.86)	.900(.854)	.903	37	.886	[-.316,.824]
Q31T	4.44(4.33)	.616(.577)	.581	37	.541	[-.276,.499]
Q32T	4.61(4.29)	.778(.644)	1.430	37	.898	[-.136,.786]
Q34T	2.78(1.33)	1.166(1.155)	3.877	37	.690	[.690,2.199]